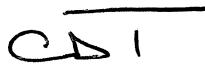


APPENDIX A



MEMO TO : File
Cass County

FROM : Craig D. Thorstenson
Environmental Engineer 
Division of Air Quality
North Dakota Department of Health

RE : Rolling Green Family Farms RE, LLP

DATE : July 21, 2016

This document provides an assessment of the air quality impacts of the proposed Rolling Green Family Farms RE, LLP facility to be located near Buffalo, North Dakota. This document is organized as follows:

- I. Introduction
- II. North Dakota Air Pollution Control Rules
 - a. Hydrogen Sulfide
 - 1. Ambient Air Quality Standards for Hydrogen Sulfide (Health Standards)
 - 2. Hydrogen Sulfide Odor Standard
 - b. Ammonia
 - c. Odor Standard
- III. Iowa Department of Natural Resources (DNR) Study
 - a. Iowa DNR Study Hydrogen Sulfide Results
 - b. Iowa DNR Study Ammonia Results
 - c. Iowa DNR Study Odor Results
 - d. Iowa DNR Study Applicability
- IV. Odor Readings from Existing Hog Facilities in North Dakota
- V. Rolling Green Facility Expected Compliance Status
 - a. Ambient Air Quality Standards for Hydrogen Sulfide (Health Standards)
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 - a. Hog Production
 - b. Air Quality Requirements
 - 1. Setback Requirements
 - 2. Odor Standards
 - 3. Hydrogen Sulfide Standards
- VII. Summary
- VIII. Conclusion

I. Introduction

Rolling Green Family Farms RE, LLP (Rolling Green) has proposed a 9,056 head hog facility to be located near Buffalo, North Dakota. The facility has applied for an Animal Feeding Operation Approval to Operate from the Division of Water Quality. During the comment period for the animal feeding operation approval, several comments were received regarding the impact of the facility on water quality. In addition, comments were received regarding the impact of the facility on air quality. The air quality comments focused primarily on the potential health effects and odor impacts of emissions from the proposed facility. Based on these concerns, the Division of Air Quality conducted a review of the proposed facility. Based on the review, the primary pollutants expected to be emitted from the facility are from animal waste and include ammonia and hydrogen sulfide. Odors are also expected due to these emissions.

The North Dakota Air Pollution Control Rules applicable to the facility are discussed in the following section.

II. North Dakota Air Pollution Control Rules

a. Hydrogen Sulfide

Hydrogen sulfide (H₂S) is not regulated as a Hazardous Air Pollutant under the federal Clean Air Act. Although there is no federal (Environmental Protection Agency) ambient air quality standard for H₂S or federal odor standard for H₂S, the North Dakota Air Pollution Control Rules have established more stringent requirements for H₂S as follows:

1. Ambient Air Quality Standards for Hydrogen Sulfide (Health Standards)

The H₂S ambient air quality standards are established under Chapter 33-15-02 of the North Dakota Air Pollution Control Rules and are maximum H₂S levels allowed in the ambient air. These levels are established to protect human health and the environment. The ambient air quality standards for H₂S are summarized in the following table:

Maximum Permissible Concentration of H₂S	Averaging Period
10.0 ppm* (10,000 ppb**)	Maximum instantaneous (ceiling) concentration not to be exceeded
0.20 ppm (200 ppb)	Maximum 1-hour average concentration not to be exceeded more than once per month
0.10 ppm (100 ppb)	Maximum 24-hour average concentration not to be exceeded more than once per year
0.02 ppm (20 ppb)	Maximum arithmetic mean concentration averaged over three consecutive months

* ppm = parts per million

** ppb = parts per billion

2. Hydrogen Sulfide Odor Standard

An odor standard of 0.05 ppm (50 ppb) for H₂S is established under Chapter 33-15-16 of the North Dakota Air Pollution Control Rules.

b. Ammonia

Ammonia is known to be emitted from confined animal feeding operations (CAFOs). Ammonia is not regulated as a Hazardous Air Pollutant under the federal Clean Air Act and there is no federal ambient air quality standard for ammonia; however, ammonia emissions are evaluated under the Policy for the Control of Hazardous Air Pollutant Emissions in North Dakota (Air Toxics Policy).

As indicated above, the federal Environmental Protection Agency (EPA) has not established allowable ambient levels for ammonia; however, acceptable exposure levels have been developed by state agencies as shown in the following table:

State Agency	Acceptable Exposure Level (ppb*)	Averaging Period
Minnesota Dept. of Health	4,590	Acute (1-hour)
	115	Chronic (annual)
California OEHHA**	4,590	Acute (1-hour)
	200	Chronic (annual)

* Both agencies listed in the table establish acceptable levels for ammonia in units of micrograms per cubic meter. The values have been converted to parts per billion (ppb).

** OEHHA = Office of Environmental Health Hazard Assessment.

The Minnesota Department of Health acute acceptable exposure level (referred to as a health risk value or HRV) is equivalent to the California OEHHA acute acceptable exposure level (referred to as a reference exposure level or REL). The Minnesota Department of Health chronic HRV is more stringent than the California OEHHA chronic REL. The Department will utilize the more stringent Minnesota values for purposes of determining compliance with the Air Toxics Policy.

c. Odor Standard

There is no standard for odor established at the federal level. Odors from the facility must meet the requirements of Chapter 33-15-16 of the North Dakota Air Pollution Control Rules. Chapter 33-15-16 establishes that the facility may not discharge into the ambient air any objectionable odorous air contaminant that causes odors that measure seven odor concentration units or higher as measured at specific locations. Chapter 33-15-16 defines an “odor concentration unit” as follows:

An “odor concentration unit” is defined as a volume of odor-free air mixed with an equal volume of odorous air such that the combination would be at the threshold level of the olfactory senses. The intensity of an odor is determined by the ratio of the volume of odor-free air that must be mixed with a standard volume of odorous air so that a

department-certified inspector or at least fifty percent of an odor panel can still detect the odor in the diluted mixture.

Note that Chapter 33-15-16 does not require non-detectable or “zero” odors. Instead, the odor standard is a state-wide standard which provides a maximum concentration that cannot be exceeded; local zoning requirements may be established to ensure that the location of the facility is acceptable (i.e., “local control” is maintained over such factors as the land use compatibility of the facility at a given location).

Under Subsection 7 of North Dakota Century Code Section 23-25-11, the Rolling Green facility is required to be setback from any existing residence, church, school, business, public building, park, or campground by a distance of one mile; therefore, under Chapter 33-15-16 of the North Dakota Air Pollution Control Rules, any odor reading to determine compliance with the odor standard must be taken at either: a) any point located beyond 1 mile from the facility; or b) within 100 feet of any existing residence, church, school, business, public building, park, or campground. Under Subsection 33-15-16-02.3 of the North Dakota Air Pollution Control Rules, the odor standard does not apply “while spreading or applying animal manure or other recycled agricultural material to land in accordance with a nutrient management plan approved by the state department of health”.

III. Iowa Department of Natural Resources (DNR) Study

Due to concerns regarding emissions from animal feeding operations, the Iowa Department of Natural Resources (DNR) conducted a study of ammonia, hydrogen sulfide and odor concentrations near large confined animal feeding operations (CAFOs). The results of the study can be accessed at the following link:

<http://www.iowadnr.gov/Environmental-Protection/Air-Quality/Animal-Feeding-Operations>

The Iowa DNR study results and the applicability of the results to the Rolling Green facility are discussed below.

a. Iowa DNR Study Hydrogen Sulfide Results

For the Iowa DNR study, H₂S monitoring was conducted at several sites near CAFOs. H₂S concentrations were monitored at 16 sites from 2002-2007. Of the 16 sites, 11 of the facilities were hog facilities. Information regarding the monitoring sites near hog facilities is summarized below.

H₂S Monitoring Results Near Hog Facilities (Maximum Hourly)

Site	Type of Nearby Facility	Permitted Capacity of Facility (pounds of livestock)	Approximate Distance from Facility to Monitor (miles)	Maximum Monitored H ₂ S Concentration (ppb; 1-hour average)
Belmond New	Hog Hog	2,310,000 and 2,475,000	1/6 1	11.7
Belmond Old	Hog Hog	2,310,000 and 2,475,000	1/6 1	12.9

Site	Type of Nearby Facility	Permitted Capacity of Facility (pounds of livestock)	Approximate Distance from Facility to Monitor (miles)	Maximum Monitored H ₂ S Concentration (ppb; 1-hour average)
Clarion	Hog Poultry	1,827,265 and Unknown	< 1/2 3/4	25.2
Goldfield	Hog	2,475,000	1/2	12.3
Iowa Falls	Hog	1,502,500	1/3	16.2
Jewell	Hog	1,462,500	1/2	32.4
Kanawha	Hog	2,310,000	1/2	15.3
Sac City	Hog	1,890,000	3/4	51.9
Stanhope	Hog Hog	2,475,000 and 1,370,145	1 1 2/3	44.5
Williams	Hog Hog	2,100,000 and 2,100,000	Next to the facility 2/5	29.9
Woodbine	Hog	3,012,000	1/2	36.8

As can be seen from the above table, the highest 1-hour average H₂S monitored concentrations near hog facilities ranged from 11.7 to 51.9 ppb.

b. Iowa DNR Study Ammonia Results

For the Iowa DNR study, ammonia monitoring was conducted at several sites near CAFOs. Ammonia concentrations were monitored at 16 sites from 2002-2007. Of the 16 sites, 11 of the facilities were hog operations. Information regarding the results for sites near hog operations is summarized below.

Ammonia Monitoring Results Near Hog Facilities (Maximum Hourly)

Site	Type of Nearby Facility	Permitted Capacity of Facility (pounds of livestock)	Approximate Distance from Facility to Monitor (miles)	Maximum Monitored Ammonia Concentration (ppb; 1-hour average)
Belmond New	Hog Hog	2,310,000 and 2,475,000	1/6 1	481.2
Belmond Old	Hog Hog	2,310,000 and 2,475,000	1/6 1	379.1
Clarion	Hog Poultry	1,827,265 and Unknown	1/3 3/4	1,182.0
Goldfield	Hog	2,475,000	1/2	1,996.0
Iowa Falls	Hog	1,502,500	1/3	607.0
Jewell	Hog	1,462,500	1/2	690.2
Kanawha	Hog	2,310,000	1/2	877.4
Sac City	Hog	1,890,000	3/4	395.9
Stanhope	Hog Hog	2,475,000 and 1,370,145	1 1 2/3	1,820.0

Site	Type of Nearby Facility	Permitted Capacity of Facility (pounds of livesock)	Approximate Distance from Facility to Monitor (miles)	Maximum Monitored Ammonia Concentration (ppb; 1-hour average)
Williams	Hog Hog	2,100,000 and 2,100,000	Next to the facility 2/5	1,104.0
Woodbine	Hog	3,012,000	1/2	696.8

As can be seen from the above, the highest 1-hour average monitored ammonia concentration recorded at each site near hog facilities ranged from 379.1 to 1,996.0 ppb.

Ammonia Monitoring Results Near Hog Facilities (Average Hourly)

Site	Type of Nearby Facility	Permitted Capacity of Facility (pounds of livesock)	Approximate Distance from Facility to Monitor (miles)	Average Hourly Monitored Ammonia Concentration (ppb)
Belmond New	Hog Hog	2,310,000 and 2,475,000	1/6 1	11.9
Belmond Old	Hog Hog	2,310,000 and 2,475,000	1/6 1	19.6*
Clarion	Hog Poultry	1,827,265 and Unknown	1/3 3/4	30.1**(26.0***)
Goldfield	Hog	2,475,000	1/2	63.1**(12.3***)
Iowa Falls	Hog	1,502,500	1/3	44.9**(26.3***)
Jewell	Hog	1,462,500	1/2	49.8**(20.0***)
Kanawha	Hog	2,310,000	1/2	15.2
Sac City	Hog	1,890,000	3/4	22.3**(12.6***)
Stanhope	Hog Hog	2,475,000 and 1,370,145	1 1 2/3	38.7**(21.3***)
Williams	Hog Hog	2,100,000 and 2,100,000	Next to the facility 2/5	26.5*
Woodbine	Hog	3,012,000	1/2	62.9*

* This monitored value was obtained at a site that did not meet the “completeness criteria” for data collection (for any year) as established by the Iowa DNR; however, the results are included for informational purposes.

** This monitored value was obtained at a site that did not meet the “completeness criteria” for data collection (for the particular year in which the value was obtained) as established by the Iowa DNR; however, the results are included for informational purposes.

*** This monitored value was obtained at a site that met the “completeness criteria” for data collection (for the particular year in which the value was obtained) as established by the Iowa DNR.

As can be seen from the above, the average hourly monitored ammonia concentration recorded at each location ranges from 11.9 to 63.1 ppb (including sites that did not meet the “completeness criteria”). For those sites where the completeness criteria were met,

the average hourly monitored ammonia concentration recorded at each location ranged from 11.9 to 26.3 ppb.

c. Iowa DNR Study Odor Results

The Iowa DNR study included the results of 304 measurements taken near a Public use area, an Educational institution, a Religious institution, a Residence, or a Commercial enterprise (referred to as a PERRC). There were 11 odor exceedances measured, which equates to an exceedance rate of 4%. An exceedance was defined as a reading greater than or equal to 7 odor concentration units, which is the same level allowed under the North Dakota Air Pollution Control Rules. The PERRC measurement distances and the number of exceedances of the 7 odor concentration unit level associated with each distance are shown below.

Distance to PERRC (meters)	Exceedances	Measurements
0-50	1	131
51-100	4	62
101-150	0	7
151-200	2	6
201-250	2	4
251-300	0	4
301-350	0	2
351-400	1	7
401-450	0	7
451-500	0	4
>500	0	45
not specified	1	25
Total	11	304
Total with a distance specified	10	279

As can be seen from the above, of the ten exceedances where a distance was specified, all exceedances were measured at a distance of 400 meters (approximately ¼ mile) or less. An exceedance was not measured at a verified distance greater than 400 meters.

In addition to the odor readings taken near a PERRC, the Iowa DNR study also included odor readings taken near the fence line of animal feeding operations and manure application sites. These results are not pertinent to the Rolling Green facility since, under Chapter 33-15-16 of the North Dakota Air Pollution Control Rules, the odor reading for odors from the Rolling Green facility must be taken at least 1 mile from the facility (since the setback distance is 1 mile and the closest existing residence is 1.5 miles from the facility) and the spreading or applying of animal manure is exempt from the odor standard (if done in accordance with a nutrient management plan approved by the Department).

d. Iowa DNR Study Applicability

The Rolling Green facility has a capacity of 9,056 head (800 nursery pigs, 1,344 farrowing sows, 5,312 gestation sows and 1,600 finishing pigs). The Iowa DNR study

classifies facility size by the pounds of livestock at the facility; for Rolling Green, the weight of the livestock at the facility is shown in the following table:

Type of Livestock	Maximum Number of Livestock	Average Weight (lbs)	Total Weight (lbs)
Nursery Pigs	800	45	36,000
Farrowing Sows	1,344	400	537,600
Gestation Sows	5,312	400	2,124,800
Finish Pigs	1,600	150	240,000
Total			2,938,000

As can be seen from the above, the Rolling Green facility has a capacity of approximately 2,938,000 pounds of livestock, which is in the same size range as the hog facilities in the Iowa DNR study.

For the Iowa DNR study, the distance from the H₂S and ammonia monitors to the hog facilities ranged from 1/6 mile to 1 mile, with nine of the eleven monitoring sites located within ½ mile of a hog facility. The Rolling Green facility required setback distance is 1.0 miles (with the closest existing residence located 1.5 miles from the facility). The greater setback distance for the Rolling Green facility is expected to result in lower hydrogen sulfide and ammonia concentrations at any existing residence, church, school, business or public building.

The monitoring sites in the Iowa DNR study appear to be located near facilities that use lagoons for manure storage. The Iowa DNR study states (in reference to odor exceedances), “Manure tanks and lagoons had exceedance rates that were approximately double those of deep pit or earthen basin manure storage structures”. Based on this information, it appears that peak odor levels will be lower at the Rolling Green facility than the facilities studied in the Iowa DNR study since the Rolling Green facility will use a deep pit for manure storage.

Based upon the above, the maximum hydrogen sulfide, ammonia and odor levels associated with the hog facilities in the Iowa DNR study are expected to be similar to or higher than the hydrogen sulfide, ammonia and odor levels which will be associated with the Rolling Green facility. Therefore, the expected compliance status of the Rolling Green facility with the allowable levels for odors, H₂S and ammonia will be assessed by comparing the monitored levels from the Iowa DNR study to the levels allowed by the North Dakota Air Pollution Control Rules. The North Dakota Department of Health odor readings (discussed in the following section) will also be considered when determining compliance with the odor standard.

IV. Odor Readings from Existing Hog Facilities Operating in North Dakota

The following large hog facilities currently operate in North Dakota:

Name	Location
Nelson County Pigs Cooperative	Argusville
Sundale Hutterian Association	Milnor

Name	Location
Bowman Auction Market	Bowman
Nordak, LLP	Scranton
Bell Farms – Wind Edge	Fort Ransom
Forest River Colony	Inkster
Enviro pork of North Dakota	Larimore
Michael German #2	Fullerton
Hexagon Pork	Cando
Dakota Country Swine	Cando
Viking Feeders	Edmore
Turtle Mountain Pork	Souris
Hilltop Pork	Raleigh

The Department has taken a significant number of odor measurements at existing hog facilities in North Dakota. The results of the odor readings are summarized in the following table.

Distance from the Facility to the Location of the Odor Measurement	Exceedances*	Measurements
Less than ¼ mile	60	312
Greater than or equal to ¼ mile and less than ½ mile	9	84
Greater than or equal to ½ mile and less than ¾ mile	6	41
Greater than or equal to ¾ mile	0	150
Total	75	587

* An exceedance is an odor reading of 7 odor concentration units or greater.

As can be seen from the above table, six exceedances were obtained at a distance greater than or equal to ½ mile. The distances at which the exceedances were obtained are shown below:

Distance from the Facility to the Location of the Odor Measurement	Exceedances*
0.5 miles	4
0.60 miles	1
0.63 miles	1
Total	6

* An exceedance is an odor reading of 7 odor concentration units or greater.

As can be seen from the above table, an exceedance of the odor standard of 7 odor concentration units has not been documented at an existing North Dakota hog facility at a distance greater than 0.63 miles (approximately 2/3 mile).

V. Rolling Green Facility Expected Compliance Status

a. Ambient Air Quality Standards for Hydrogen Sulfide (Health Standards)

The maximum monitored 1-hour H₂S concentration was 51.9 ppb, which was obtained at the Sac City site. The Sac City site is located approximately ¾ mile from a 1,890,000

pound hog facility and the monitoring at the site was conducted over a 4-year period. EPA recommended factors can be used to estimate concentrations for averaging periods other than a 1-hour averaging period. A 24-hour average pollutant concentration can be estimated by multiplying the 1-hour average concentration by 0.4, resulting in a maximum expected 24-hour average H₂S concentration of approximately 20.8 ppb. The maximum quarterly concentration is expected to be less than half of the maximum 24-hour average concentration. The maximum expected H₂S levels and the applicable ambient air quality standards (AAQS) for H₂S are summarized in the following table:

Averaging Period	ND AAQS for H ₂ S (ppb)	Expected H ₂ S Level (ppb)
Instantaneous	10,000	<< 10,000*
1-hour	200**	< 52
24-hour	100***	< 21
Quarterly	20****	< 10

* The odor standard for H₂S is 50 ppb; therefore, the odor standard will be exceeded well before the instantaneous AAQS is approached. Instantaneous H₂S readings can be measured by the Department if the facility becomes operational. The “<<” symbol denotes that instantaneous H₂S concentrations are expected to be significantly less than 10,000 ppb.

** Not to be exceeded more than once per month.

*** Not to be exceeded more than once per year.

**** Maximum arithmetic mean concentration averaged over three consecutive months.

Based upon the available information, ambient H₂S levels from the operation of the Rolling Green facility are expected to be below the ambient air quality standards for H₂S.

b. Hydrogen Sulfide Odor Standard

As indicated previously, the North Dakota odor standard for H₂S is 50 ppb. There is not a federal health-based ambient air quality standard for H₂S or a federal odor standard for H₂S.

For the hog facilities in the Iowa DNR study, the maximum monitored 1-hour average H₂S concentration is 51.9 ppb, which was obtained at the Sac City site. The Sac City site is located approximately ¾ mile from a 1,890,000 pound hog facility and the monitoring at the site was conducted over a 4-year period. The 51.9 ppb reading was the only 1-hour average reading obtained at the site that was over 50 ppb; the five highest 1-hour readings at the site over the 4-year period were 51.9 ppb, 23.9 ppb, 19.5 ppb, 18.0 ppb and 17.7 ppb. The highest 1-hour average reading obtained during each monitoring year at the site was 11.2 ppb, 19.5 ppb, 51.9 ppb and 15.1 ppb for years 2004, 2005, 2006 and 2007, respectively. The monitoring site appears to have been operational for over 29,600 hours during the 4-year period; as indicated above, only one reading was obtained above 50 ppb during this period (i.e., a 1-hour reading above 50 ppb was obtained less than 0.01% of the time the monitor was operating).

The combined hours of operation for all H₂S monitoring sites at hog facilities over the course of the Iowa DNR study appears to be over 296,500 hours. During this monitoring, only one 1-hour average reading above 50 ppb was obtained (i.e., a 1-hour reading above

50 ppb was obtained less than 0.001% of the time the monitors were operating). It is unclear what caused this reading above 50 ppb to occur; however, this reading appears to be an anomaly and is not indicative of normal 1-hour average H₂S levels associated with hog facilities in the Iowa DNR study.

Based upon the available information, ambient H₂S levels from the operation of the Rolling Green facility are not expected to exceed the H₂S odor standard. It should be noted that H₂S odors may be noticeable at levels below the H₂S odor standard. The US Occupational Safety and Health Administration (see <https://www.osha.gov/SLTC/hydrogensulfide/hazards.html>) states that the odor threshold for H₂S is approximately 10 ppb to 1,500 ppb, with odors becoming more objectionable at levels of 3,000 to 5,000 ppb; therefore, some individuals may be able to detect H₂S odors at levels below the 50 ppb odor standard. The OSHA maximum permissible exposure level (PEL) of 20,000 ppb is well above the odor threshold.

c. Odor Standard

The North Dakota Air Pollution Control Rules require that an odor reading to establish a violation of the odor standard of 7 odor concentration units be taken at the setback distance for the facility (one mile in the case of Rolling Green). In the Iowa DNR study, no odor readings exceeding the 7 odor concentration unit standard were obtained at a distance greater than 400 meters (approximately ¼ mile). For North Dakota facilities, no odor readings exceeding the 7 odor concentration unit standard were obtained at a distance greater than 2/3 mile. Based upon this information, an odor level exceeding the odor standard of 7 odor concentration units is unlikely to occur at a distance greater than 1 mile from the proposed Rolling Green facility. Therefore, emissions from the Rolling Green facility are expected to comply with the odor standard. It should be noted that odors are detectable at a level well below the enforceable odor standard.

d. Ammonia

As indicated previously, expected ammonia levels from a facility are reviewed in accordance with the Air Toxics Policy.

The highest 1-hour average monitored ammonia concentration from the Iowa DNR study was 1,996.0 ppb; this level is below the acute health-based level for ammonia of 4,590 ppb.

The average hourly ammonia concentration will be used to approximate the annual average concentration for purposes of comparison to the chronic (annual) health-based level for ammonia. The highest average hourly monitored ammonia concentration from the Iowa DNR study was 63.1 ppb (at a site that did not meet the “completeness criteria” for data collection as established by the Iowa DNR). The highest average hourly monitored ammonia concentration at a site that met the “completeness criteria” was 26.3 ppb. Both the 26.3 and 63.1 ppb levels are below the chronic health-based level for ammonia of 115 ppb.

Based upon the available information, ambient ammonia concentrations due to emissions from the Rolling Green facility are expected to be below the health-based levels for

ammonia; therefore, emissions from the facility are expected to comply with the requirements of the Air Toxics Policy.

VI. Hog Production and Air Quality Requirements in Surrounding States

Concerns have been expressed regarding the stringency of North Dakota environmental regulations as compared to neighboring states and whether an inequity in regulatory requirements has resulted in an increase in hog production in North Dakota. In response to these concerns, the Department reviewed hog production data for surrounding states and Iowa to determine if hog production has shifted from neighboring states to North Dakota. The Department also reviewed air quality requirements for neighboring states and Iowa to determine if the air quality requirements are substantially different in these states. These two topics (hog production and air quality requirements) are discussed below.

a. Hog Production

The US Department of Agriculture (USDA) National Agriculture Statistics Service publishes a national hog inventory which can be accessed at the following website:

https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Hog_Inventory/

Iowa is by far the leading hog producing state. The 2015 end-of-year hog inventories of Iowa, North Dakota and the states surrounding North Dakota are shown below:

State	2015 Hog Inventory	Percent of US Total*
Iowa	20,800,000	30.5%
Minnesota	7,950,000	11.6%
South Dakota	1,360,000	2.0%
Montana	176,000	0.3%
North Dakota	138,000	0.2%
Total		44.6%

* Total U.S. hog inventory at the end of 2015 was estimated to be 68.3 million.

The 2011 hog inventories for the above-referenced states are shown below:

State	2011 Hog Inventory	Percent of US Total*
Iowa	19,800,000	30.0%
Minnesota	7,800,000	11.8%
South Dakota	1,390,000	2.1%
Montana	180,000	0.3%
North Dakota	151,000	0.2%
Total		44.4%

* Total U.S. hog inventory at the end of 2011 was estimated to be 65.9 million.

The percent change in hog inventory from 2011 to 2015 is shown in the following table:

State	Hog Inventory (2011)	Hog Inventory (2015)	Percent Change
Iowa	19,800,000	20,800,000	+5.1%
Minnesota	7,800,000	7,950,000	+1.9%
South Dakota	1,390,000	1,360,000	-2.2%
Montana	180,000	176,000	-2.2%
North Dakota	151,000	138,000	-8.6%
US Total	65,9000,000	68,300,000	+3.6%

As can be seen from the above, Minnesota and Iowa dominate the regional hog market with 40+% of the total US hog inventory. From 2011 to 2015, the hog inventory increased slightly in Iowa and Minnesota, increased slightly in the US and decreased slightly in the other states (including North Dakota). There did not appear to be any significant shift in hog production from neighboring states to North Dakota during the period of 2011-2015.

b. Air Quality Requirements

The primary methods of reducing the air quality impact from hog facilities are through the establishment of: a) setback requirements; b) odor standards; and c) H₂S standards. The air quality requirements for a new facility with the capacity of Rolling Green constructed in Minnesota, Iowa, South Dakota and North Dakota are compared below.

1. Setback Requirements

Setback requirements in North Dakota vary based on the size of the facility (expressed in “animal units”, which are defined by rule). The number of animal units at the Rolling Green facility is shown in the following table:

Type of Livestock	Maximum Number of Livestock	Average Weight (lbs)	Animal Unit Factor*	Total Animal Units**
Nursery Pigs	800	45	0.1	80.0
Farrowing Sows	1,344	400	0.4	537.6
Gestation Sows	5,312	400	0.4	2,124.8
Finish Pigs	1,600	150	0.4	640.0
Total				3,382.4

* Per Chapter 23-25 of the North Dakota Century Code, one swine weighing 55 pounds or more equals 0.4 animal unit and a swine weighing less than 55 pounds equals 0.1 animal unit.

** Calculated by multiplying the number of a particular livestock (1st column) by the animal unit factor shown in the 4th column.

Per Chapter 23-25 of the North Dakota Century Code, if there are at least 2,001 animal units but no more than 5,000 animal units at a facility, then the setback for a hog operation is one mile. As can be seen from the above, the Rolling Green

facility will have approximately 3,382 animal units; therefore, the required setback distance for the Rolling Green facility is one mile.

Setback requirements for states are compared in the following table:

State	Setback Requirement (miles)*
North Dakota	1.0
Iowa	0.6**
Minnesota	0.8***
South Dakota	0.5***

* For a new facility with the capacity of the Rolling Green facility.

** For a new facility of over 3,000 animal units, the setback is 3,000 feet (0.57 mile). This is a state-wide requirement. Local zoning ordinances may be more stringent.

*** Setback requirements are established by local zoning ordinance in Minnesota and South Dakota. The setback distance shown for Minnesota is for Pipestone County, Minnesota. The setback requirement in several South Dakota counties where the parent company of Rolling Green operates facilities is 0.5 miles. Other local authorities may have different setback requirements.

As can be seen from the above, the North Dakota setback requirement for the Rolling Green facility is more stringent than the minimum setback requirement for a similar facility located in Iowa, Minnesota and South Dakota.

2. Odor Standards

Odor standards are compared in the following table:

State	Odor Standard
North Dakota	7 odor concentration units
Iowa	No odor standard
Minnesota	No odor standard
South Dakota	No odor standard

North Dakota has established a state-wide odor standard, whereas Iowa, Minnesota and South Dakota have not established a state-wide odor standard. North Dakota has established an instantaneous odor standard for H₂S. Iowa, Minnesota and South Dakota do not have an odor standard for H₂S.

3. Hydrogen Sulfide Standards

The H₂S standards are compared in the table below. The numeric H₂S standards are difficult to compare due to different averaging periods and the fact that some standards allow periodic exceedances; therefore, a discussion of the standards follows the table.

State	H ₂ S Ambient Standard (ppb)	Averaging Period
North Dakota	50*	Instantaneous
	200	1-hour (not to be exceeded more than once per month)
	100	24-hour (not to be exceeded more than once per year)
	20	Quarterly
Iowa	30**	1-hour (daily maximum 1-hour average not to be exceeded more than seven days in one year)
Minnesota	50***	½ hour average not to be exceeded over two times per year
	30***	½ hour average not to be exceeded over two times in any five consecutive days
South Dakota	No ambient standard for H ₂ S	---

* The 50 ppb H₂S limit is an odor standard. North Dakota also has established a 10,000 ppb instantaneous ambient standard for H₂S; however, the 50 ppb odor standard will be exceeded well before the 10,000 ppb instantaneous ambient air quality standard.

** “Health effects standard” which only applies to animal feeding operations.

*** The owner of an animal feedlot is exempt from the state ambient air quality standards during the removal of manure from barns or manure storage facilities.

As can be seen from the above, Iowa and Minnesota have more stringent ambient air quality standards (i.e., “health-based standards”) for H₂S; however, the North Dakota H₂S odor standard of 50 ppb is an instantaneous standard that is expected to be exceeded more readily than the Iowa and Minnesota ambient air quality standards (which are based on ½ hour and 1-hour averages). In addition, establishing an exceedance of an ambient air quality standard based on a ½ hour or 1-hour average is significantly more difficult in practice compared to establishing an exceedance of an instantaneous odor standard. This is due to the complexity of the equipment at an ambient air monitoring site (which is necessary to monitor compliance with a ½ hour or 1-hour ambient air quality standard). Exceedances of the 50 ppb North Dakota odor standard can be established using a portable monitoring device.

For the Iowa H₂S ambient air quality standard, the eighth-highest reading over the year is used to demonstrate compliance with the standard. From the Iowa DNR study, the highest eighth-highest reading at any site is 20.8 ppb, which is below the Iowa H₂S ambient air quality standard of 30 ppb. As indicated previously, ambient pollutant concentrations due to the Rolling Green facility are expected to be lower than the ambient pollutant concentrations measured at the facilities in the Iowa DNR study (in part due to the more stringent setback requirements established in North Dakota); therefore, ambient H₂S concentrations due to the

Rolling Green facility are expected to be below the Iowa 1-hour H₂S ambient air quality standard of 30 ppb. Compliance with the Iowa H₂S ambient air quality standard would likely result in compliance with the Minnesota H₂S ambient air quality standards (given that the Minnesota 30 ppb standard is allowed to be exceeded two times in any five consecutive days); therefore, ambient H₂S concentrations due to the Rolling Green facility are expected to be below the Minnesota ½ hour H₂S ambient air quality standard of 30 ppb.

Based upon the available information, North Dakota air quality requirements applicable to the Rolling Green facility are determined to be substantially equivalent to the air quality requirements applicable to a similar facility operating in Iowa, Minnesota or South Dakota (the main hog producing states near North Dakota).

VII. Summary

The EPA does not currently regulate hydrogen sulfide or ammonia emissions from hog facilities. In addition, the EPA has not established a national ambient air quality standard for hydrogen sulfide and has not established a national odor standard. The North Dakota Air Pollution Control Rules establish requirements for emissions of hydrogen sulfide, ammonia and odors which are more stringent than federal requirements. North Dakota air quality requirements are designed to protect human health and minimize air quality impacts from sources of air emissions (including hog facilities). For example, the rules establish a state-wide odor standard which allows a certain level of odors; however, the rules do not require that a facility cause no odors. Issues such as the desirability of a particular facility at a given location must be addressed through local zoning requirements as zoning is not under the purview of the North Dakota Department of Health.

North Dakota air quality requirements applicable to hog facilities are substantially equivalent to the air quality requirements applicable to hog facilities locating in the main hog producing states near North Dakota.

Based upon the available information, emissions from the proposed Rolling Green facility are not expected to exceed the allowable levels established by the North Dakota Air Pollution Control Rules. If a facility is found to exceed the allowable levels established by the rules, the Department will require measures to bring operations into compliance.

VIII. Conclusion

Based upon a review of the proposed facility and other information summarized in this document, emissions from the proposed Rolling Green facility are expected to comply with the applicable requirements of the North Dakota Air Pollution Control Rules.

CDT:saj